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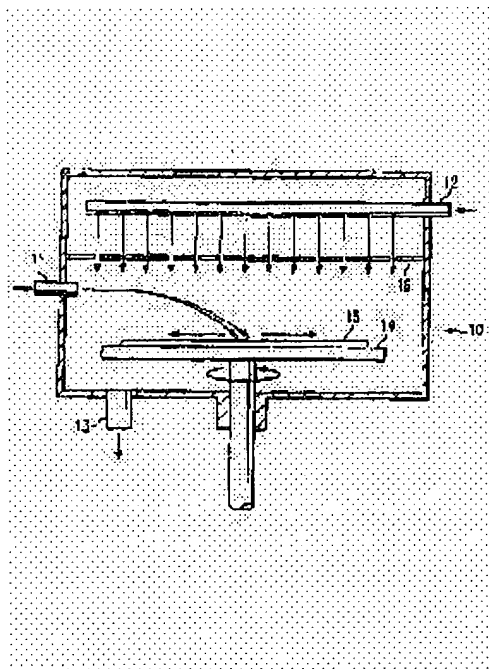
Priority country : US

## (54) MANUFACTURE OF SEMICONDUCTOR

## (57)Abstract:

PROBLEM TO BE SOLVED: To remove the traces of an oxide and other contaminants from etched silicon surface by a method wherein the flow of deionized water is applied to a wafer, the deionized water is brought into contact with specific gas, and some quantity of the gas is absorbed into the deionized water.

SOLUTION: When a semiconductor is manufactured by a silicon wafer having silicon oxide, at least a part of the silicon oxide is selectively removed by etching using HF gas and H<sub>2</sub>O vapor. Besides, the stream of deionized water is applied to a wafer 15, the deionized water is brought into contact with the gas selected from the group consisting of anhydrous HF gas, HCl gas, ozone and its mixture, and at least some gas is absorbed to the deionized water. As above-mentioned, the etched wafer 15 is washed. For example, the etched wafer 15 is rotated, and the deionized water is streamed on the rotating wafer 15, and the deionized water is brought into contact with HF gas through the stream of deionized water on the rotating wafer 15.



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**LEGAL STATUS**

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rejection or application converted  
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# PATENT ABSTRACTS OF JAPAN

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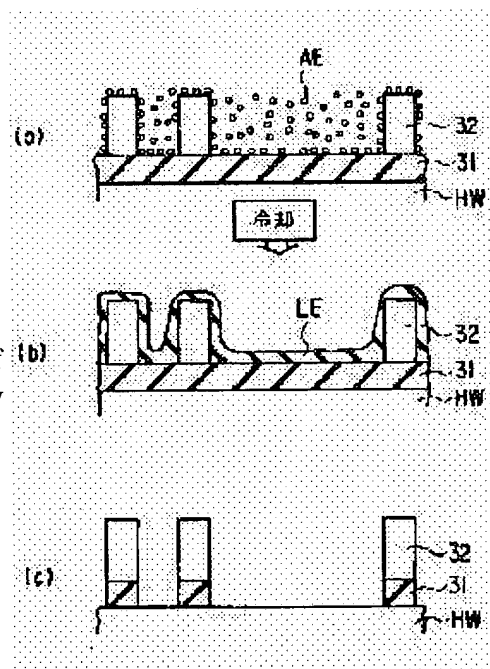
## (54) SEMICONDUCTOR EQUIPMENT AND MANUFACTURING METHOD

### (57)Abstract:

PROBLEM TO BE SOLVED: To enhance uniformity of etching in a wafer in a spin etcher for etching an insulation film on the wafer face.

SOLUTION: A wafer HW is held by a wafer holding part in a chamber. Under this condition, an evaporated etchant AE from an evaporated etchant introducer is heated by a heater and introduced into the chamber.

It is sprayed substantially uniformly onto the entire face of the wafer HW from an injection port of a shower plate. Thereafter, the wafer HW is cooled by a cooler, and the evaporated etchant AE sprayed onto a face of the wafer HW is liquefied. The wafer HW is spun by a motor and a below insulation film 31 is etched according to a pattern of a resist film 32.



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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD  
PRIOR ART EFFECT OF THE INVENTION TECHNICAL  
PROBLEM MEANS DESCRIPTION OF DRAWINGS  
DRAWINGS

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## CLAIMS

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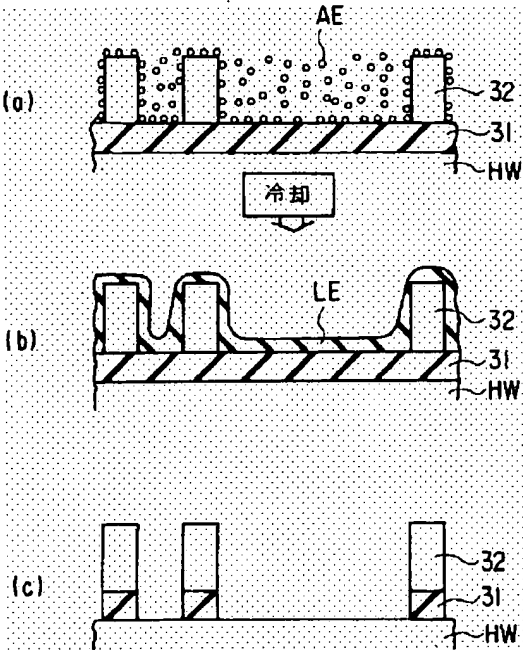
### [Claim(s)]

[Claim 1] Semiconductor fabrication machines and equipment characterized by providing the feed zone supplied to it, heating the processing agent of an evaporation condition on the front face of a semi-conductor substrate in which the detailed pattern was formed, and the processing section which liquefies said processing agent supplied to the front face of said semi-conductor substrate by this feed zone, and carries out etching processing of the front face of said semi-conductor substrate using the processing agent of that liquefaction condition.

[Claim 2] Said feed zones are semiconductor fabrication machines and equipment according to claim 1 characterized by coming to have an evaporation means to make said processing agent evaporate, a heating means to heat the processing agent evaporated by this evaporation means, and a spraying means to spray the processing agent heated with this heating means on the front face of said semi-conductor substrate.

[Claim 3] Said processing section is the semiconductor fabrication machines and equipment according to claim 1 carry out [ coming to have in the processing room where sealing was given, a maintenance means hold said semi-conductor substrate in this processing interior of a room, a cooling means liquefy said processing agent which cooled this maintenance means and was supplied to the front face of said semi-conductor substrate,

and a rotation means rotate said maintenance means after



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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is used for etching the insulator layer of the front face of a wafer, or its front face especially about semiconductor fabrication machines and equipment and the manufacture approach.

[0002]

[Description of the Prior Art] Conventionally, the spin etcher is known as equipment which etches the insulator layer of the front face of a wafer, or its front face according to a pattern. This spin etcher rotates a wafer and supplies etchant liquid to the core of that rotation. And the inside of a wafer side is etched into homogeneity for the etchant liquid by [ good ] making it cross all over a wafer according to a centrifugal force.

[0003] However, in the above-mentioned conventional spin etcher, there was a problem that supply of the etchant liquid to a detailed pattern was unstable, and produced dispersion in the amount of etching in a wafer side.

[0004] Drawing 5 shows the etching actuation by the conventional spin etcher. In recent years, the demand of etching by the detailed pattern of sub mu order of an advance [ semiconductor technology ] has been increasing splendidly.

[0005] However, as shown in this drawing (a), when etching the insulator layer 2 of the front face of a wafer 1 using a spin etcher, the pattern of the resist film 4 cannot fully supply etchant liquid 3 to a detailed part with the surface tension of etchant liquid 3.

[0006] Consequently, as shown in this drawing (b), the etching remainder of an insulator layer 2 arose in the part with the detailed pattern of the resist film 4, and there was a fault that uniform etching could not be performed.

[0007]

[Problem(s) to be Solved by the Invention] As described above, in the former, there was a problem that supply of the etchant liquid to a detailed pattern was unstable, and produced dispersion in the amount of etching in a wafer side.

[0008] Then, this invention can etch a detailed pattern good and aims at offering the semiconductor fabrication machines and equipment which can be improved in the homogeneity of etching within a substrate side, and the manufacture approach.

[0009]

[Means for Solving the Problem] If it is in the semiconductor fabrication machines and equipment of this invention in order to attain the above-mentioned purpose, it consists of a feed zone which supplies to it, heating the processing agent of an evaporation condition on the front face of a semi-conductor substrate in which the detailed pattern was formed, and the processing section which liquefies said processing agent supplied to the front face of said semi-conductor substrate by this feed zone, and carry out the etching processing of the front face of said semi-conductor substrate using the processing agent of that liquefaction condition.

[0010] Moreover, if it is in the semi-conductor manufacture approach of this invention, the semi-conductor



substrate with which the detailed pattern was formed in the processing interior of a room is held, after spraying the processing agent evaporated and heated on the front face of that semi-conductor substrate and liquefying this processing agent, said semi-conductor substrate is rotated and etching processing of the front face of that substrate is carried out according to said detailed pattern.

[0011] According to the semiconductor fabrication machines and equipment and the manufacture approach of this invention, a processing agent can be supplied to stability also to a detailed pattern, without being influenced by surface tension. Thereby, it becomes possible to promote the etching reaction in a detailed pattern.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is explained with reference to a drawing. Drawing 1 shows the outline configuration of the spin etcher concerning one gestalt of operation of this invention.

[0013] This equipment liquefies the evaporation etchant feed zone which supplies evaporation etchant (processing agent) to the front face of Wafer (semi-conductor substrate) HW in which the detailed pattern was formed, and the evaporation etchant supplied to the front face of the above-mentioned wafer HW, and is constituted by the etching processing section which carries out etching processing of the front face of the above-mentioned wafer HW using that liquefaction etchant.

[0014] The above-mentioned etching processing section is N2 for making into a pressurization condition the inside of the chamber 11 for etching, the wafer attaching part 12 which holds Wafer HW within this chamber 11, the cooling system 13 which cools the above-mentioned wafer HW through this wafer attaching part 12, the motor 14 made to rotate the above-mentioned wafer attaching part 12, and the above-mentioned chamber 11. It consists of a gas transfer unit 15 etc.

[0015] The above-mentioned evaporation etchant feed zone consists of a heater 17 which heats the evaporation etchant from the evaporation etchant installation equipment 16 which introduces evaporation etchant in the above-mentioned chamber 11, and this evaporation etchant installation equipment 16, a shower plate 18 which sprays the above-mentioned evaporation etchant heat-treated at this heater 17 on the front face of the above-mentioned wafer HW.

[0016] Sealing is given to the above-mentioned chamber 11 so that evaporation etchant may not leak. The above-mentioned wafer attaching part 12 consists of a revolving shaft 22 for rotating the wafer chuck 21 and this wafer chuck 21 for carrying out vacuum adsorption of the above-mentioned wafer HW, as shown in drawing 2.

[0017] The cooling pipe 24 for supplying the cooling medium from the vacuum tubing 23 for leading the vacuum force from the vacuum device which is not illustrated to the top face of the above-mentioned wafer chuck 21 and the above-mentioned cooling system 13 in the above-mentioned wafer chuck 21 is formed in the above-mentioned wafer chuck 21 and the revolving shaft 22, respectively.

[0018] The above-mentioned cooling system 13 is constituted by Zillah, and cools the temperature of the above-mentioned wafer HW below to the dew-point of evaporation etchant. Above N2 A gas transfer unit 15 is N2. Liquefaction of evaporation en CHANTO is promoted by introducing gas by pressurizing the inside of the above-mentioned chamber 11, and lowering the partial pressure of evaporation etchant.

[0019] As shown in the above-mentioned shower plate 18 at drawing 3, much injection-tip 18a for spraying the evaporation etchant heated at the above-mentioned heater 17 all over the above-mentioned wafer HW is prepared.

[0020] In addition, further, in case internal discard is discharged, the damage elimination equipment 19 for removing harmful matter is formed in the above-mentioned chamber 11. Drawing 4 shows the etching actuation by the spin etcher of a configuration of having described above.

[0021] First, the wafer HW with which etching processing is presented is held by the wafer attaching part 12 in the chamber 11 for etching. At this time, vacuum adsorption of the above-mentioned wafer HW is carried out by the predetermined vacuum force supplied to the top face of the wafer chuck 21 through the vacuum tubing 23 from the vacuum device which is not illustrated.

[0022] As for the above-mentioned wafer HW, an insulator layer 31 is uniformly formed in the front face, further, on it, it has a detailed pattern and the resist film 32 is formed. In this condition, the evaporation

etchant AE from evaporation etchant installation equipment 16 is introduced in the above-mentioned chamber 11. The evaporation etchant AE is heated at a heater 17, and is mostly sprayed on homogeneity all over [ a / of the shower plate 18 / injection-tip 18] the above-mentioned wafer HW (this drawing (a)).

[0023] Installation of the evaporation etchant AE of fixed time amount or a constant rate supplies the cooling media (for example, cooling water, an oil coolant, etc.) from a cooling system 13 in the above-mentioned wafer chuck 21 through a cooling pipe 24.

[0024] Then, the wafer chuck 21 is cooled and Wafer HW falls below to the dew point temperature of the above-mentioned evaporation etchant AE in connection with it. Thereby, the above-mentioned evaporation etchant AE sprayed on the front face of the above-mentioned wafer HW is liquefied (this drawing (b)).

[0025] Moreover, at the time of this liquefaction, it is N<sub>2</sub>. N<sub>2</sub> from a gas transfer unit 15 Gas is supplied in the above-mentioned chamber 11. Consequently, the inside of the above-mentioned chamber 11 is pressurized, the partial pressure of the above-mentioned evaporation etchant AE is lowered, and liquefaction of evaporation etchant AE is promoted.

[0026] Thus, by making evaporation etchant AE liquefy, it is not influenced by the surface tension of Etchant LE, but a pattern can supply Etchant LE also to a detailed part at stability.

[0027] Then, the above-mentioned wafer chuck 21 is rotated through a revolving shaft 22 by the motor 14, and the spin of the wafer HW is carried out. Thereby, etching processing according [ the etching reaction on the above-mentioned wafer HW side ] to a supply rate limiting next door and liquefaction etchant LE is promoted. Consequently, the insulator layer 31 under it is etched into a mask at homogeneity according to the pattern of the above-mentioned resist film 32 in the above-mentioned resist film 32 (this drawing (c)).

[0028] That is, the pattern of the resist film 32 becomes possible [ fully supplying liquefaction etchant LE also to a detailed part ]. For this reason, uniform etching without dispersion can be performed, without producing the etching remainder of the insulator layer 31 in that part.

[0029] In addition, N<sub>2</sub> which remains in the above-mentioned chamber 11 through damage elimination equipment 19 after this etching actuation is completed After removing harmful matter from gas, liquefaction etchant LE, etc., it is discharged out of the above-mentioned chamber 11.

[0030] It enables it to stabilize supply of the etchant to a detailed pattern, without being influenced by surface tension as described above. That is, etchant is made to evaporate, a wafer front face is supplied, and it is made to supply etchant by making it liquefy. Thereby, since etchant can fully be supplied on a detailed pattern, it becomes possible to promote the etching reaction in a detailed pattern. Therefore, on the whole surface of a wafer, it can etch good, and it becomes possible to improve the homogeneity of etching within a wafer side.

[0031] In addition, in one gestalt of operation of above-mentioned this invention, although the case where the insulator layer on the front face of a wafer was etched was explained, not only this but when etching the front face of a wafer, it can apply. In addition, of course in the range which does not change the summary of this invention, deformation implementation is variously possible.

[0032]

[Effect of the Invention] As mentioned above, as explained in full detail, according to this invention, a detailed pattern can be etched good, and the semiconductor fabrication machines and equipment which can be improved in the homogeneity of etching within a substrate side, and the manufacture approach can be offered.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The block diagram showing roughly the spin etcher concerning one gestalt of implementation of this invention.

[Drawing 2] The outline sectional view showing the configuration of a wafer attaching part similarly.

[Drawing 3] The block diagram showing a shower plate roughly similarly.

[Drawing 4] The outline sectional view similarly shown in order to explain etching actuation.

[Drawing 5] The outline sectional view of the etching actuation shown in order to explain the conventional technique and its trouble.

[Description of Notations]

11 [ -- A motor, 15 / -- N<sub>2</sub> / A gas transfer unit, 16 / -- A shower plate, 18a / -- An injection tip, 19 / -- Damage elimination equipment, 21 / -- A wafer chuck, 22 / -- A revolving shaft, 23 / -- Vacuum tubing, 24 / -- A cooling pipe, 31 / -- An insulator layer, 32 / -- The resist film, HW / -- Wafer. / -- Evaporation etchant installation equipment, 17 -- A heater, 18 ] -- The chamber for etching, 12 -- A wafer attaching part, 13 -- A cooling system, 14

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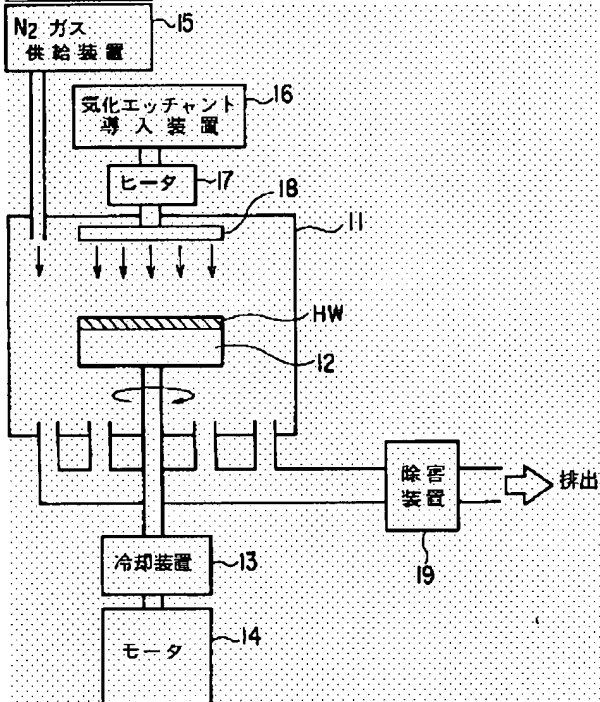
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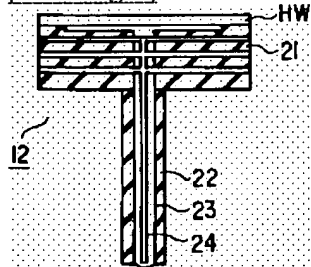
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DRAWINGS

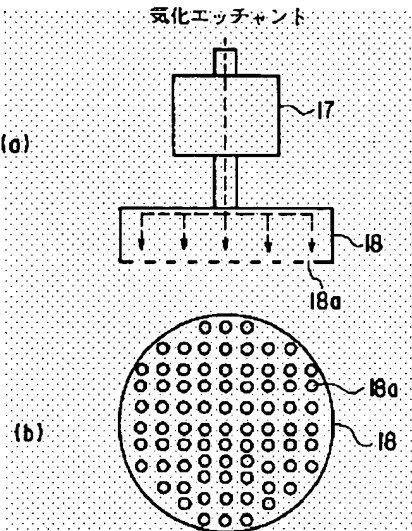
[Drawing 1]



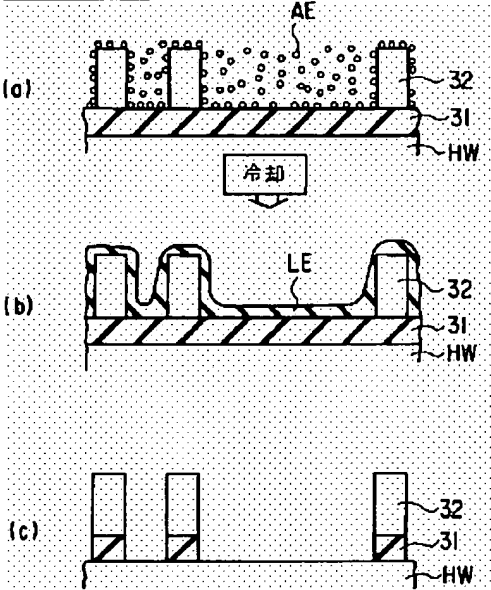
[Drawing 2]



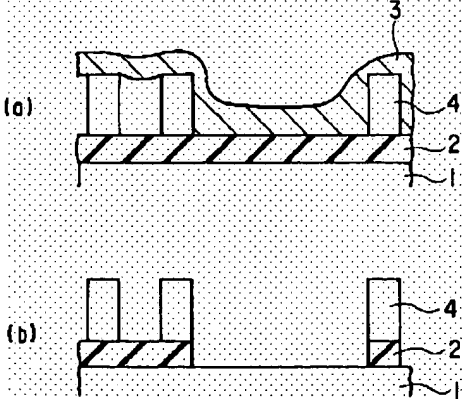
[Drawing 3]



[Drawing 4]



[Drawing 5]



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